ROLE OF FLUOROSCOPIC GUIDED PERCUTANEOUS TRANSPEDICULAR BIOPSY IN DIAGNOSING SPINAL PATHOLOGIES.

Dissertation Submitted For

M.S. DEGREE EXAMINATION

BRANCH - II ORTHOPEDIC SURGERY

DEPARTMENT OF ORTHOPAEDIC SURGERY

MADRAS MEDICAL COLLEGE

CHENNAI - 600 003

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI- 6000032.

MARCH – 2008

CERTIFICATE

This is to certify that the dissertation titled ***"Role of fluoroscopic guided percutaneous transpedicular biopsy in diagnosing spinal pathologies"*** is the original work done by ***Dr.P.Chandrasekaran,*** post graduate in M.S., Orthopaedic Surgery at the Department of Orthopedic Surgery, Madras Medical College, Chennai-600 003 to be submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai- 600 032, towards the partial fulfillment of the requirement for the award of M.S., Degree in Orthopaedic Surgery, March 2008.

Dr. V. Thulasiraman, M.S. Orth. D.Orth.
Addl.Professor of Orthopaedic Surgery,
Department of Orthopaedic Surgery,
Madras Medical College,
Chennai - 3.

Prof.Mayil Vahanan Natarajan,
M.S.Orth.(Ma's),M.Ch.Trauma(L'pool)
PhD(orth.onco),D.Sc.,F.A.M.S.,D.Sc(Hon)
Head,
Department of Orthopaedic Surgery,
Madras Medical College,
Chennai - 3.

Dr. T.P. KALANITI, M.D.,
Dean
Madras Medical College,
Chennai - 3.

ACKNOWLEDGEMENT

I express my thanks and gratitude to our respected Dean **Dr. T.P. KALANITI, M.D.**, Madras Medical College, Chennai-3 for having given permission for conducting this study and utilize the clinical materials of this hospital.

I have great pleasure in thanking my teacher **Padma laureate** Prof. **MAYIL VAHANAN NATARAJAN MS Orth (Ma's), M.Ch., Trauma (L'Pool), Ph.D.(Orth onco), D.Sc.,F.A..M.S. ,D.Sc(Hon),**Prof and Head department of orthopedic surgery, for his valuable advice and guidance.

My sincere thanks and gratitude to **Dr. K.ANBAZHAGAN, M.S.Orth, D.Orth,** Additional Professor, Department Of Orthopedic Surgery for constant advice and guidance provided throughout this study..

My sincere thanks and gratitude to **Dr. R.H.GOVARDHAN M.S,Orth., D.Orth.,** Additional Professor, Department Of Orthopedic Surgery for his valuable advice and guidance.

My sincere thanks and gratitude to my guide **Dr. V. THULASIRAMAN M.S.Orth., D.Orth,** Additional Professor, Department Of Orthopedic Surgery for his constant inspiration and guidance.

I am very much grateful to **Dr. R. SUBBIAH, M.S.Orth., D.Orth,** for his unrestricted help and advice throughout the study period.

I sincerely thank **Dr. NALLI R. UVARAJ M.S.Orth., D.Orth,Reader ,** for his advice, guidance and unrelenting support during the study.

I sincerely thank Dr. R. Selvaraj, Dr. V. Mazhavan, Dr. Pasupathy, Dr. T.R.RameshPandian, Dr.AntonyVimalraj, Dr.N.B.Thanmaran, Dr.Velmurugan, Dr. Karunakaran, Dr. Manimaran, Dr. Shanmuga Sundaram, Dr.Nalli R. Gopinath, Dr. Muthazhagan, Assistant Professors of this department for their valuable suggestions and help during this study.

I thank all anesthesiologists and staff members of the theatre for their endurance during this study.

I am grateful to all post graduate colleagues for helping me in this study.

Last but not least, my sincere thanks to all our patients, without whom this study would not have been possible.

AIM

- To evaluate the efficacy of the technique of fluoroscopic guided percutaneous transpedicular biopsy of vertebral bodies in spinal pathologies.

- To come to a sure histopathological diagnosis in vertebral body lesions.

INTRODUCTION

Spine lesions are commonly seen in day to day practice. But diagnosing vertebral lesions are most of the time difficult and non-specific even with specialized investigations and hence the need for histopathological diagnosis is important. Histopathological diagnosis requires intervention.

Earlier application of aspiration biopsy in lesions of the spine is of great interest because the vertebral bodies cannot be surgically approached in order to diagnosis.

Open biopsy was the traditional method for diagnosing spine lesions. It is well known that the open biopsy maximizes tissue retrieval, providing the highest diagnostic success rate. Usually open biopsy follows a failed needle biopsy or it is done in patients with selected presumed primary bone or cartilaginous tumors.

Open method of biopsies has the drawback as it is a major procedure with its antecedent complications like hematoma, infection, tumor seedling in the biopsy tract and additional morbidity. Hence there is a

need for closed biopsy techniques. The standard approach for obtaining a percutaneous biopsy sample of the thoracolumbar lesion is a posterolateral one. Standard posterolateral approach involves passing the needle lateral to the transverse process, with the needle penetrating the skin 6-7cm lateral to the midline and following 45^{o} angle to the vertebral body. Although this approach has been generally effective, technique related difficulties and complications like nerve root injury, pneumothorax, hematoma particularly in the thoracic region were common. Concerned about the length of the biopsy tract Filder and Neers[4] performed open transpedicular biopsy technique.

Percutaneous transpedicular biopsy of the vertebral lesion is considered an alternate to paraspinal biopsy for lesions involving the vertebral bodies of the thoracic and lumbosacral spine. It has been reported to be an efficacious, safe and cost effective approach. In most cases it can be done with the patients under local anesthesia with fluoroscopic guidance.

REVIEW OF LITERATURE

On reviewing the literature, Robertson and Ball's[22] paper mentions about aspiration biopsy in fifteen patients in 1935 as a blind procedure. The technique was not described in detail. They noted that it was difficult to obtain cartilaginous and fibrous material by this method and warned of danger of injury to the cord.

Jose Valls and Ottolenghi[21] (1948) were the earlier authors who initiated the aspiration biopsy lesions of the vertebral bodies. They found that the last four cervical vertebra, last three dorsal vertebra and lumbar vertebra can be punctured without difficulty. They cautioned in puncturing the upper thoracic vertebra as the parietal pleura, oesophagus, large vessels are intimate contact with the vertebral body.

W.Ackerman[27,28] (1956) did biopsy of the iliac crest as a control along with the vertebra and found that four of fifty patients had positive vertebral biopsy for metastasis as compared with one iliac crest positive for metastasis. He abandoned doing iliac crest biopsies later.

It has been said that all a malignant tumors will eventually metastasis to bone and this was well illustrated by Francis and Hutter[21] (1963) who reported a series of 118 spinal metastasis from 24 different primary sites.

Schajowicz[12] (1968) in the series of 4050 needle biopsies including 941 punctures of the spine in 25 years of experience has utilized the cytological study of the smear and the histopathology interpretation which was resulted in a high percentage (76%) of positive result.

Though Engzell and Von Schroeb (1979) have mentioned the possibility of tumour spread through the needle tract review of literature has not revealed any evidence of this complication in a large combined experience of several thousand cases. This has been emphasized by De Santos[17] and many others like Keith Rabinov and Schjowicz[12].

William Murphy[26] (1981) emphasizes that percutaneous needle placement and methylprednisolone may be an effective method for treating solitary bone cyst or eosinophilic granuloma.

Percutaneous biopsy of the thoracic spine was earlier done by Craig in 1956 and by Ackermann[27-28] in 1963. But Ottolengthi[21] modified valls technique and reported a biopsy procedure for the thoracic guidance but involving the use of a metallic instrument to guide the biopsy needle.

Kris J.Vandom et al[26] (1988) retrospectively analysed 62 cases of computed tomography of the spine and provided the criteria for diagnosing infection versus tumor in the spine distinctly with computed tomography. They assessed each case with paraspinal soft tissue mass, bone destruction, involvement of posterior elements, multiplicity of lesion, gas pattern within bone and soft tissue, marginal sclerosis and osseous alterations which they characterized for neoplastic, pyogenic and non-pyogenic lesion. The most reliable criteria for neoplastic processes were posterior element involvement, partial or absent soft tissue involvement and ostoblastic alteration. Pyogenic processes can be identified with complete prevertebral soft tissue involvement, diffusely lytic bone involvement, gas within the disc space with involvement of disc. Non-pyogenic infection was distinguished from pyogenic sepis by the presence of focal lytic bone involvement with maginal sclerosis.

Jean Dennis Laredo and Khaled Lakdari et al[10] (1995) utilized computed tomography for differentiating benign from malignant causes of non-trumatic acute vertebral collapse. They categorized that in bengin acute vertebral collapse there is cortical fracture of the vertebral body without cortical bone destruction, retropulsion of a bone fragment of the posterior cortex of the vertebral body into the spinal canal, fracture lines within the cancellous bone of the vertebral body, an intracertebral vacuum phenomenon and a thin diffuse paraspinal soft tissue mass are evident.

In case of malignant acute vertebral collapses there is destruction of the anterolateral or posterior cortical bone of the vertebral body, destruction of the cancellous bone of the vertebral body, destruction of a vertebral pedicle, a focal paraspinal soft tissue mass and an epidural mass.

Malcolm W.Fidler[18] reported that the standard posterolateral needle biopsy contaminates every compartment along the biopsy tract and may produce a paravertebral hematoma.

Donald L.Renfrew[4] reported that vertebral body lesions are encountered that are ill suited to the standard posterolateral approach. The author used a transpedicular approach to spine biopsy. Certain lesions are difficult to access with the posterolateral approach, because the transverse process, iliac crest, rib obstruct the needle path. Posterocentral lesions are difficult to access with the posterolateral approach.

Advantages of Percutaneous Transpedicular Biopsy

- Needle track is sharper.
- Transverse process and mamillary process join at an acute angle and helps guide tip towards the pedicle.
- The biopsy needle is perpendicular to the cortex of the bone at the point of entry.
- Cortical bone along the posterior aspect of the pedicle is quite thin.

The radical resection of a primary malignant or locally aggressive spinal tumor requires an en bloc removal of the lesion and of any biopsy track and haematoma caused by the biopsy. This is almost impossible after a standard posterolateral needle biopsy: this

contaminantes every compartment along the track and may produce a contaminated paravertebral haematoma. Malcolm W.Fidler[18] described an alternative technique of biopsy through transpedicular route.

Ashizawa R.Ohtsuka K[2] evaluated the clinical validity of this less invasive diagnostic method in terms of accuracy of pathological diagnosis from 28 thoracic or lumbar vertebras of 26 patients who underwent percutaneous transpedicular needle biopsy under local anesthesia and concluded that the accuracy rate of diagnosis with this biopsy was 92% without significant intra or post operative complications.

Laurent Pierot and Anne Boulin[16] performed percutaneous biopsy via a transpedicular approach under fluoroscopic guidance from 18 patient's vertebral lesions in thoracic or lumbar spine and found that the accuracy rate of this diagnosis was 89% and concluded that it is safe, provided that technique is performed with rigorous exactitude.

Alexander G.Hadjipavlou[1] carried out 71 percutaneous transpedicular biopsy specimens from 68 patients with cervical, thoracic, lumbar and sacral vertebra under local anesthesia and found that efficacy of this

procedure to be 94% and concluded that this procedure is safe, efficacious and cost effective.

Martin Kornblum[19] did retrospective study of 103 CT guided percutaneous biopsy and found 71% - 100% sensitivity and found that it is safe, accurate and relatively inexpensive modality for obtaining tissue samples of spinal lesions.

In a large series of CT-guided spinal biopsy specimens, the diagnostic accuracy was rated 71%, with the thoracic spine having the lowest diagnostic yield[1]. This was attributed to a more challenging approach for the thoracic spine. The pleural space, aortic arch, descending aorta, major veins, esophagus, and posterior mediastinum all are at potential risk during biopsy of the thoracic spine. The transpedicle passage of the biopsy instruments helps to avoid complications from these vital structures and also yields a better diagnostic accuracy.

The familiarity with transpedicular screw placement helps a lot to do transpedicular retrieval of biopsy material.

ANATOMY OF THE SPINE / VERTEBRAL COLUMN

Embryology of Vertebral Column

The vertebral column is formed from the sclerotome of the somities. The cell of each sclerotome gets converted into loose mesenchyme encircling the notochord, extends backwards on the either side of the neutral tube and extends laterally and ventrally to be occupied by the transverse process and ribs respectively.

The mesenchymal cells become condensed running transversely in the middle of the segment called the perichondral disc. The centre of each vertebra is formed by the fusion of the adjoining less condensed parts of two segments. The perichondral discs become the intervertebral discs. The neural arch, transverse process and costal elements are formed as same as the body. The interspinous and intertransverse ligaments are formed as intervertebral disc.

The notochord disappears in the region of the vertebral bodies and at intervertebral discs becomes expanded and forms the nucleus pulposus.

The vertebral column is the central pillar of the body. It serves to protect the spinal cord and supports the weight of head and trunk. It is made up of vertebra separated by fibrocartilagenous intervertebral discs.

The vertebrae are arranged as Cervical (7), Thoracic (12), Lumbar (5), Sacral (5), and Coccygeal (4). A typical vertebra consists of a body anteriorly and a vertebral arch posteriorly. The vertebral arch has a pair of pedicles anteriorly and flattened laminae posteriorly within which run the spinal cord with its coverings.

The vertebral arch gives rise to seven processes, one spinous, two transverse, two superiors and two inferior articular processes.

The spinous process is directed posteriorly from the junction of lamina. The transverse processes are directed laterally from the junction of the lamina and pedicles. The articular processes arise at the junction of the pedicle and lamina and articulate such that the superior articulate processes of the inferior vertebrate from a joint with the inferior articular processes of above vertebra.

The first cervical vertebra atlas has no body and no spinous process. It is a ring of bone with anterior and posterior arches and a lateral mass on each side. It articulates with the occipital condyles above and below with the axis. Rest of the cervical vertebra has a foramen in transverse process.

The thoracic vertebra increase in size from above downward. The body is heart shaped and presents with facets for articulation of the ribs.

The lumbar vertebra is massive and kidney shaped. The pedicles and lamina are strong and thick.

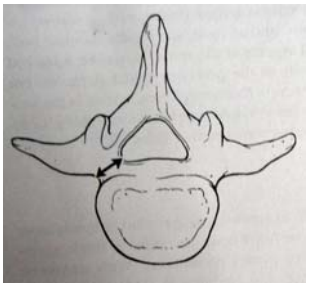
Sacrum is a wedge shaped bone with concavity anteriorly. It articulates with the fifth lumbar vertebra superiorly and with coccyx inferiorly.

The vertebral foramen is large and triangular in cervical, small and circular in thoracic and triangular in lumbar regions. The vertebral foramina are present in the sacrum and form the sacral canal. The coccyx is a fused triangular bone.

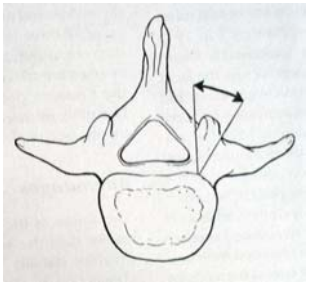
Pedicles

Pedicles are the strongest cortical portions of the vertebra. It is a hollow cylindrical bone containing thick cortical bone with very less cancellous bone in the centre. It acts as a anatomical bridge between posterior spinal elements and the vertebral body.

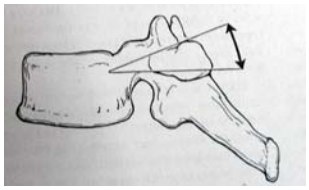
Pedicle size and angulations varies throughout the spinal column. The transverse pedicle width is narrower than the sagittal pedicle width (pedicle height) except in the lower lumbar spine. Pedicle width is more important than pedicle height for entry point in transpedicular biopsy. The transverse pedicle width increases from L_1 to S_1. Most of the pedicles below T_{10} are greater than 7mm in transverse diameter and most below L_1 are greater than 8mm in diameter.



Pedicle Width



Coronal Pedicle Angle



Sagittal Pedicle Angle

The transverse pedicle angle or coronal plane angulation decreases as one descends caudally in the spine until the lumbar region. The angle increases as the lumbar spine is descended. The sagittal pedicle angle is steep throughout the midthoracic spine and in the upper lumbar spine.

The intrathecal nerve roots course along the medial aspect of the pedicle. At D_{12} the dural sac is 0.2 to 0.3mm away from the pedicle. Below L1, the medial side of the pedicle is almost touching the cauda equina. The nerve root occupies the ventral and rostral one third of the foramen. As a result, violation of the medial or caudal cortex of the pedicle risks injuring to the nerve root.

The cervical pedicles slant obliquely forwards and medially at an angle 30 degrees. It is oval in shape 10mm by 7mm. The entry point should

be directed 3 to 4mm above the center of superior articular facet and 20 degrees medially.

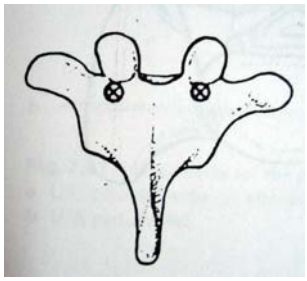
In the upper thoracic spine the inferior pedicles are oval and vertical. They are located between superior and inferior articular facets and extend upwards to the level of inferior quarter of superior facet. They slant inwards by 20 degreed and downwards by 15 degrees.

In the mid-thoracic region the angle is less being 10 degrees inwards and 10 degrees downwards. The thoracic pedicles are 4 to 6mm thick and the point of entry is 3mm below the center of superior facet. Thoracolumbar pedicles are larger about 8mm wide and has only 5 degrees slant medially.

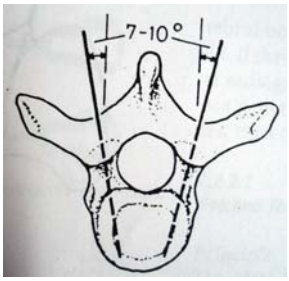
The lumbar pedicles lie in the sagittal plane perpendicular to the axis of the canal. The thickness ranges from 10 to 20mm. The first sacral pedicle is very broad. Its inferior limit is first sacral foramen.

DETERMINATION OF THE POSITION OF TRANSPEDICULAR BIOPSY NEEDLE

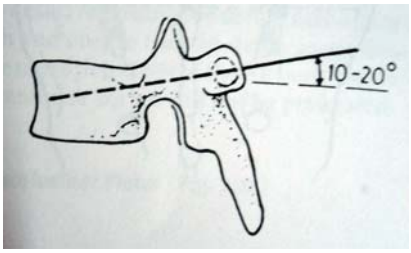
Dorsal Spine



The point of entry is just below the rim of the upper facet joint.

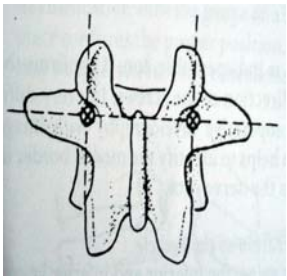


Needle should be angled 7-10^{o} towards the midline and

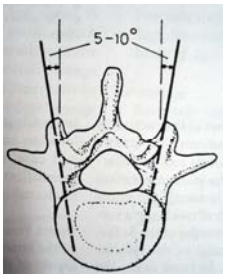


10-20^{o} caudally.

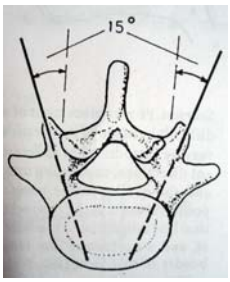
Lumbar Spine



The entry point for the pedicle is at the intersection of a vertical line tangential to the lateral border of the superior articular process and a horizontal line bisecting the transverse process.

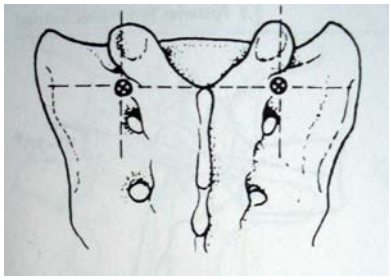


The needle should converge by 5^{o} at the thoracolumbar junction.

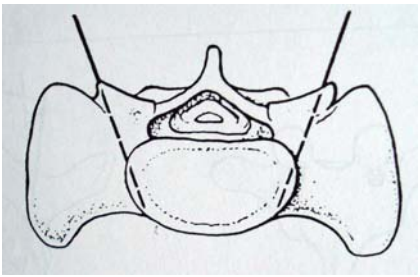


The needle should converge by 10^{o} at L2, increasing to 15^{o} at L5.

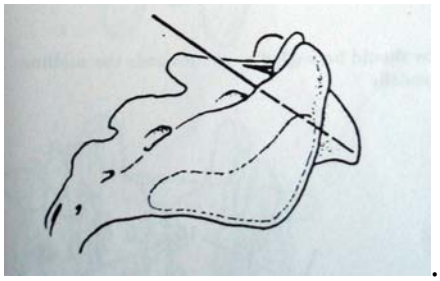
Sacral Spine



The entry point for the S1 pedicle is at the intersection of a vertical line tangential to the lateral border of the S1 facet and a horizontal line tangential to its inferior border.



The needle should converge towards the midline.



The needle should aim towards the anterior corner of the promontorium.

MATERIALS AND METHODS

The study was conducted in Department of Orthopedics, Madras Medical College and Government General Hospital, Chennai, over a period of 1 year from August 2006-Spetember 2007. Selective patients with symptomatic vertebral body lesion were taken for the study.

The relevant history was taken and salient clinical findings were noted in all patients. General examination with detailed clinical, neurological and orthopaedic examination was done to arrive for a provisional clinical diagnosis.

Non radiological investigations including E S R, Mantoux test and serum alkaline phosphatase was done. Bleeding time and clotting time was done in all cases.

Radiographs pertaining to the site of lesion obtained for all cases with anteroposterior and lateral views. Chest X ray, ultrasonogram of abdomen, CT, MRI scan was done in selected patients. The information from the clinical examination and various imaging

modalities were noted and provisional radiological diagnosis was made.

Pre Biopsy Preparation

All patients were informed of the study and explained about the importance of this investigation in the management of his or her disease and written consent was obtained from each of these patients. All patients were put under pre-procedural antibiotic cover.

Equipments Required

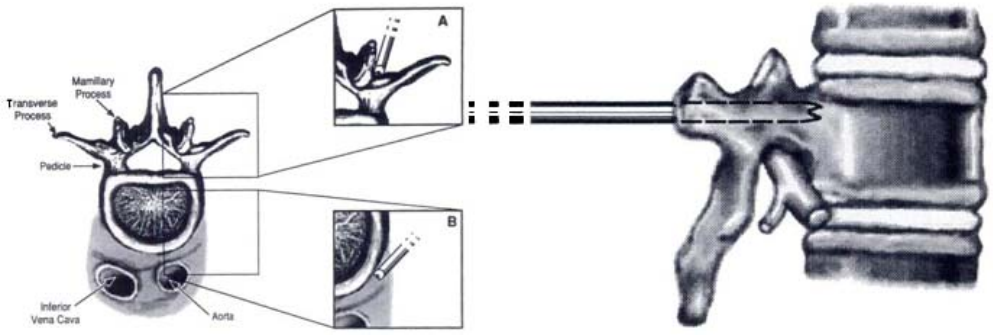
- Specially designed trocar with cannula of inner diameter 2mm, to obtain an adequate tissue for diagnosis.
- Bone awl to identify the pedicle of vertebra and entry point.
- C arm image intensifier for guidance.
- Relton Hall frame for positioning the patients.

The Technique

Before the procedure, a CT scan of targeted vertebra is obtained to appreciate the pedicle width and its angulation in the axial plane. The pedicle selected for the vertical biopsy depended on the location of the lesion with in the vertebra.

Cannula with trocar and bone awl

Prone position on Hall frame

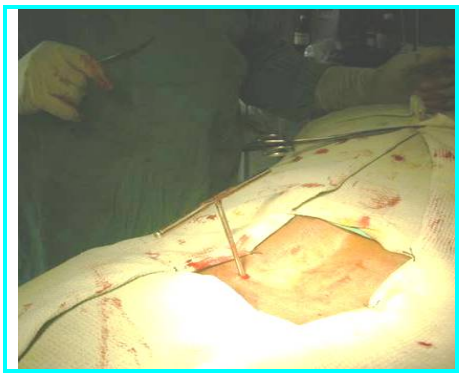


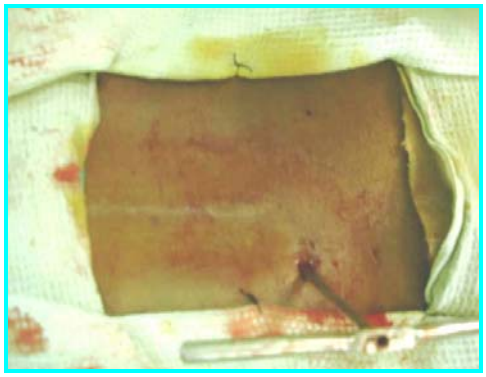
Relationship of nerve root, pedicle and needle during transpedicular biopsy.

Procedure

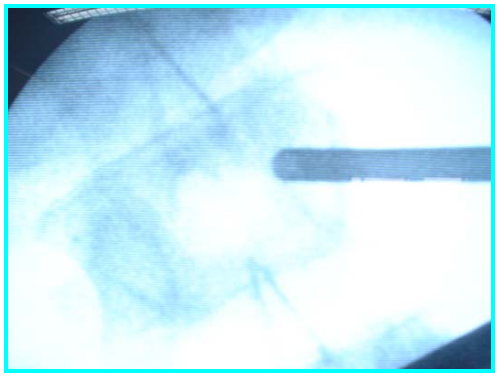
- A C-arm image intensifier is used for continuous monitoring of the needle track during biopsy.
- The patient is put in a prone position on Hall frame. The diseased vertebra was identified by A-P and lateral view.
- In the A-P view, the C-arm is angled along the inclination of the pedicle selected for biopsy until an end-on view of the center of the pedicle (the bull's eyes) is obtained.
- Bone awl was positioned on pedicle and confirmed with image intensifier for the determination of the track of the trocar to avoid violation of the pedicle margins.
- A small stab incision is made and entry point made with bone awl and the trocar with cannula is placed in the same point.

Pedicle broached with bone awl





Needle confirmation with biplanar image intensification



- The trocar is removed and the cannula advanced through the pedicle into the body towards the lesion intended for biopsy as determined by the fluoroscopy on A-P and lateral views.
- As the biopsy instrumentation is introduced in to the vertebral body, tissue is impacted between the inner walls of the cannula. Cannula is withdrawn; biopsy material was collected and analyzed macroscopically and microscopically.
- Using this technique we have never failed to retrieve tissue through a transpedicle biopsy.
- If more tissue is required, the cannula can be reintroduced by tilting it in various directions to increase tissue sampling.

Analysis of the Specimen

Macroscopic Analysis:

The specimen was analyzed with regard to the number, length and its nature. The specimen was described as solid, fragmented or caseous.

Microscopic Analysis:

It was done by the pathologist in Government General Hospital.

After the procedure the vital signs were recorded and patient was kept in the ward for 24 hrs. Neurological examination was done.

Macroscopic Analysis:

Average number of specimen

Average length of specimen

Nature of specimen

- Solid and cylindrical
- Fragile

Microscopic Analysis:

Definitive diagnosis

Inconclusive diagnosis

OBSERVATION AND RESULTS

The following were the observation made in the present study. Out of 20 cases 60% were male and 40% were female.

SEX INCIDENCE

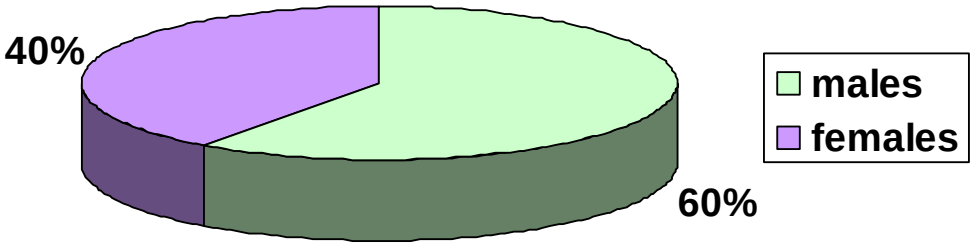
Male	Female
60% (12)	40% (8)

The figures in the bracket show the number of cases. The number of patients split according to the age group is shown below

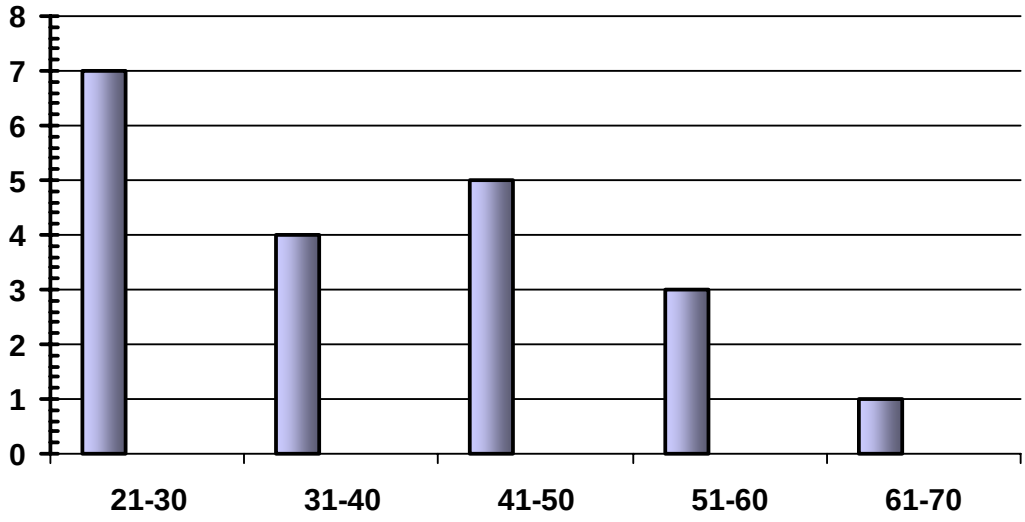
AGE INCIDENCE

Age	No. of Cases	Percentage	Male	Female
21-30	7	35	5	2
31-40	4	20	3	1
41-50	5	25	2	3
51-60	3	15	1	2
61-70	1	5	1	-

Sex Distribution



Age Distribution



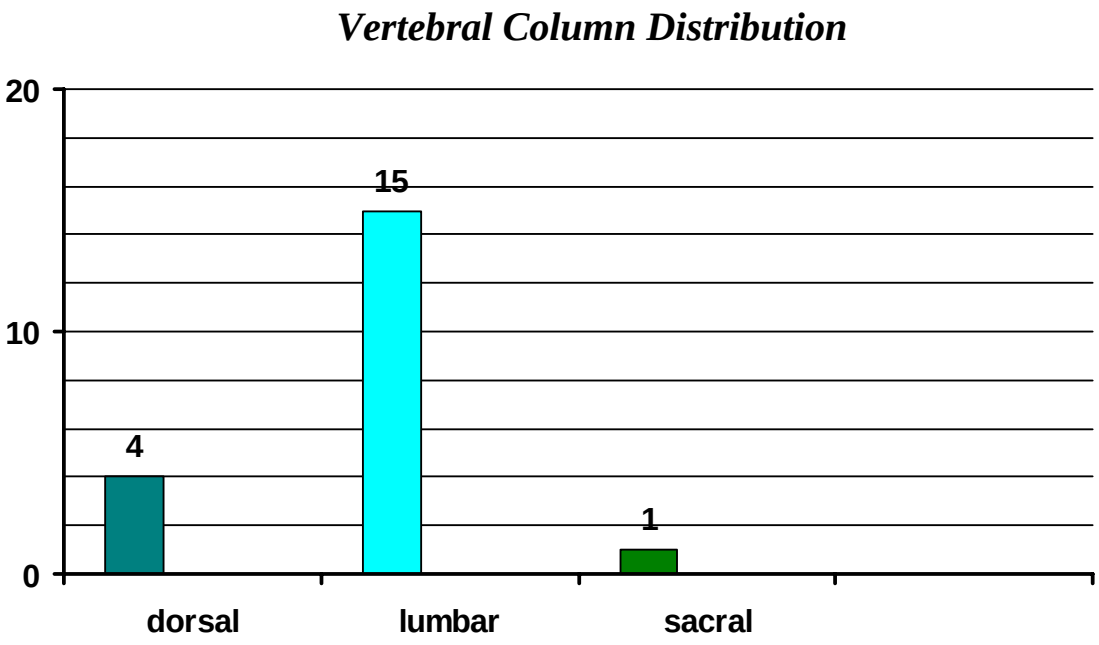
The youngest age is 22yrs and oldest is 68yrs. High incidences of 16 cases were seen in the age group between 20yrs and 50yrs. Pain was the constant symptom that made patients to seek medical advice which was found in all cases. Local tenderness in the spine was found in most of the patients.

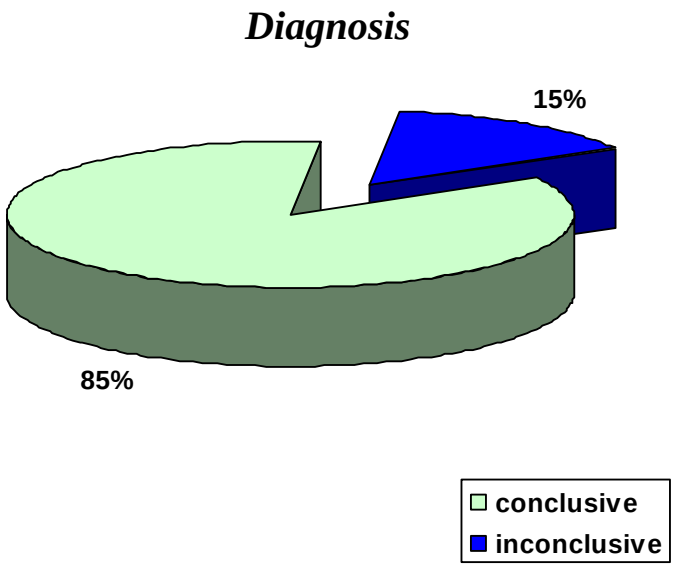
SITE OF VERTEBRAL COLUMN INVOLVEMENT

Site	No. of cases	Percentage
Dorsal	4	20%
Lumbar	15	75%
Sacral	1	5%

Diagnostic accuracy of percutaneous transpedicular biopsy in different spinal segments is shown below:

Biopsy Site	No. of cases	Positive results	Percentage
Dorsal	4	4	100%
Lumbar	15	12	80%
Sacral	1	1	100%


Vertebral Column Distribution
20
10
0
4
15
1
dorsal
lumbar
sacral


Diagnosis
15%
85%
conclusive
inconclusive

SPECIMEN ANALYSIS

Cases	No. of specimen	Length of specimen	Nature of specimens
1	2 Fragile bits		
2	1	5mm	Solid, cylindrical
3	Multiple fragile bits		
4	Fragile bits		
5	1	12mm	Solid, cylindrical
6	1	13mm	Solid, cylindrical
7	2	10, 25mm	Solid, cylindrical
8	1	25mm	Solid, cylindrical
9	1	10mm	Solid, cylindrical
10	2	14mm	Solid, cylindrical
11	3	2, 10, 15mm	Solid, cylindrical
12	1	5mm	Solid, cylindrical
13	2	10, 20mm	Solid, cylindrical
14	2	10mm	Solid, cylindrical
15	1	20mm	Solid, cylindrical
16	1	10mm	Solid, cylindrical
17	1	10mm	Solid, cylindrical
18	Fragile bits		
19	1	22mm	Solid, cylindrical
20	1	5mm	Solid, cylindrical

This biopsy technique permitted us to obtain sufficient material for histological examination. Out of 20 cases biopsy material was solid, cylindrical in 16 cases and in rest of the 4 cases we obtained fragile bits.

Specimen Analysis

BIOPSY DIAGNOSIS

	Infective	Non-Infective		
		Benign	Malignant	
			Primary	Secondary
	Tuberculosis			
No. of Cases	8	3	2	4

The final diagnosis were **tuberculosis** (n=8), **Aneurysmal Bone Cyst** (n=1), **Giant Cell Tumor** (n=1), **Paget's disease** (n=1), **Multiple Myeloma** (n=2), **Metastatic Adenocarcinoma** (n=4) and **inconclusive** results in 3 cases.

Diagnosis	**No. of cases**
Tuberculosis	8
Aneurysmal Bone Cyst	1
Giant Cell Tumour	1
Paget's disease	1
Multiple Myeloma	2
Metastatic Adenocarcinoma	4
Inconclusive	3

CASE ILLUSTRATION

CASE- 1

28/M presented with pain in low back for 6 months.

No constitutional symptoms.

No neurological deficit

Clinical diagnosis: Lumbo sacral strain.

X-ray: Osteolytic lesion in L4 body.

CT scan: Well defined expanding osteolytic lesion in right side of L4 body.

Radiological diagnosis: D/D-Giant.Cell tumour, Aneurysmal bone cyst.

CT guided biopsy: Not conclusive.

Percutaneous transpedicular biopsy was done under G.A.

Macroscopic analysis:

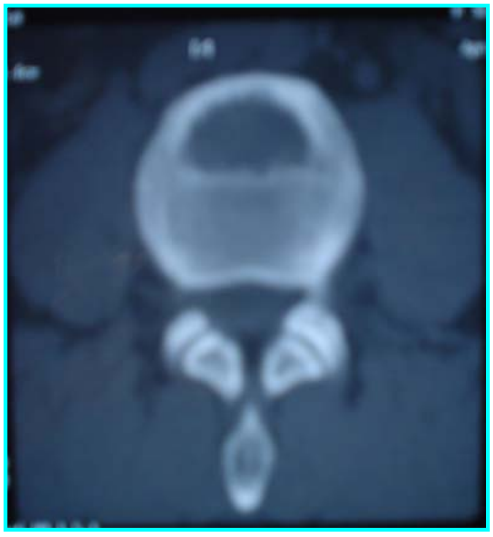
- 2 specimen
- fragile bits.

Histopathological Diagnosis:

ANEURYSMAL BONE CYST.

Osteolytic Lesion L4

Specimen: Fragile Bits



CASE- 2

45/M presented with pain in low back, fever, weight loss.

Spastic Paraparesis.

Clinical diagnosis: T.B Spine

X-ray: L4 body destruction.

MRI - lytic lesion L4 with nerve root changes.

Radiological diagnosis:D/D Secondaries, Caries spine

Percutaneous transpedicular biopsy was done under G.A.

Macroscopic analysis:

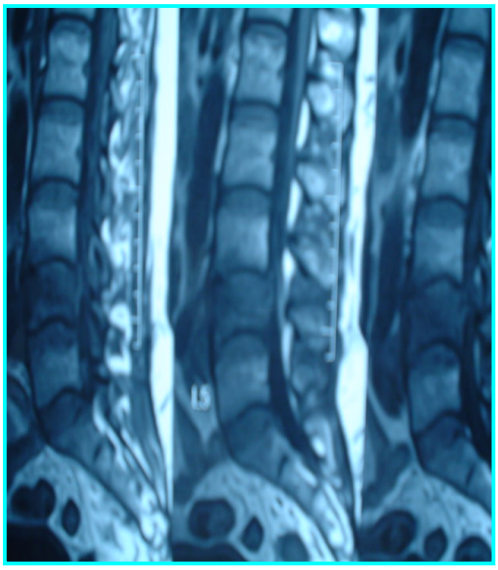
- Multiple fragile bits.

Histopathological diagnosis:

TUBERCULOSIS.

L4 Body destruction

Osteolytic Lesion L4



Specimen: Fragile Bits

CASE-3

25/M presented with complaints of pain in low back.

Weakness of ankle dorsiflexors and EHL.

X-ray: Osteolytic lesion L5 body

Radiological diagnosis: D/D-Giant.Cell tumour, Aneurysmal bone cyst

CT guided biopsy: not conclusive.

Percutaneous transpedicular biopsy was done under G.A.

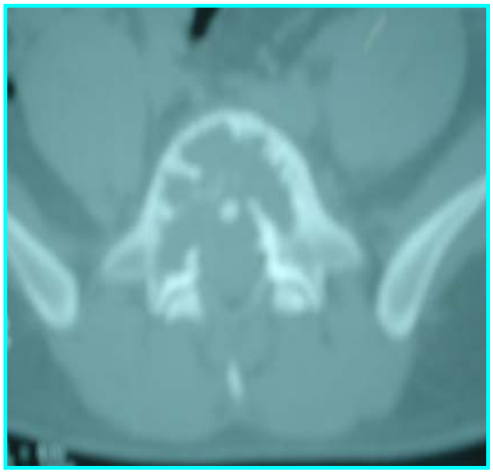
Macroscopic analysis:

- 1 specimen
- 5 mm
- Solid cylindrical

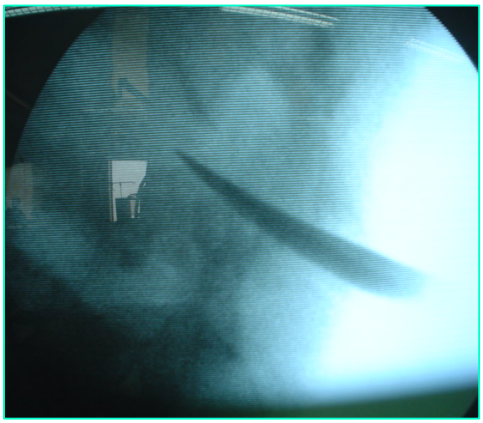
Histopathological diagnosis:

GIANT CELL TUMOUR.

Osteolytic Lesion L5



Biopsy needle through pedicle



Specimen: Solid, Cylindrical

CASE-4

26/M presented with pain in the back and constitutional symptoms.

L5 radiculopathy.

Clinical diagnosis:Caries spine

X-ray: L5-S1 destruction

MRI: Lesion predominantly involving disc space.

Radiological diagnosis: Spondylodiscitis.

Percutaneous transpedicular biopsy was done under L.A.

Macroscopic Analysis:

- 2 specimen
- 5 mm and 10mm
- Solid cylindrical

Histopathological diagnosis:

INCONCLUSIVE.

Lesion in lower part of L5 body

Lesion involving

L5-S1 disc space

Specimen - Solid

DISCUSSION

The skeletal system particularly the spine is the repository for metabolic, infectious and neoplastic disease. Patients with such involvement often present with roentgengraphically visible, but otherwise obscure lesions, Benign bone lesions sometimes resemble metastasis, metastasis lesion simulate infection and extensive metastasis may be seen in other bones with solitary lesions involving the spine.

The proper treatment for these patients depends with the accurate diagnosis by means of histopathological identification.

In our study of 20 patients, positive histopathological diagnosis was possible in 85% of cases. This study corresponds well with the literature[1,16].

Many cases presented with osteolytic lesion which is a common presentation as seen in literature. Incidence of Tuberculosis was more in our study (40%) Metastasis was noticed in patients from fifth to sixth decade (20%).

Tuberculosis infection was seen at all ages and with equal sex incidence. The area of involvements favored the lumbar region which is commonly seen 75%. The reduction of intervertebral disc space was the commonest presentation in cases of tuberculosis.

Biopsy always permitted us to obtain sufficient material for histopathological examination, which led to an accurate diagnosis in 17 cases (85%). In the remaining 3 cases, conclusive results were not obtained. In one of these, lesion was located predominantly located in the intervertebral disc space.. Hence transpedicular biopsy provided sample which is not representative of the lesion. With empirical antituberculous treatment patient showed clinical improvement and he is under follow-up.

Laurent Pierot and Anne Boulin[16], laid down the indication for using either the posterolateral or transpedicular approach depend on the location of the lesion. If the lesion is located predominantly in the disc space, as in cases of infectious disease, the posterolateral approach should be used. This approach is also mandatory when a lesion is located in the lower part of the vertebral body; however if the lesion is

located in the posterior half of the vertebral body or if the pedicle is involved the transpedicular approach is an effective method of biopsy. In case of lesions of the entire vertebral body, transpedicular approach is usually preferred.

In other case of inconclusive result patient died before further evaluation.

In another case repeat biopsy was done by the same technique.

In most of our cases (n=17) biopsy was done under GA. In rest of the cases (n=3) biopsy was done under LA and conscious sedation. This provides monitoring of nerve root function during the procedure and helps to minimize its morbidity.

With a CT guided biopsy continuous monitoring is not possible whereas with fluoroscopic monitoring, real time positioning of the needle is possible during intraosseous insertion of the biopsy instrument more comfortably in difficult anatomic location[1].

The risk involved in the percutaneous vertebral biopsy has been variously estimated at 0-7.6% in the literature[7,14]. The most frequently reported complication was pulmonary, neurology and infective disorder.

In our small series of percutaneous transpedicular biopsy no complications were encountered. Neurological examinations were unchanged after the biopsy procedure. No back or radicular pain was observed; either immediately after biopsy or during the days that followed and no pulmonary complications were observed. In most of our cases post operative hospital stay lasted at least 24 hrs. All patients returned to their prebiopsy level of daily activities the next day.

The only absolute contraindication for this procedure was patients with uncorrected bleeding diathesis.. Duration of this procedure was between 15 to 30 minutes.

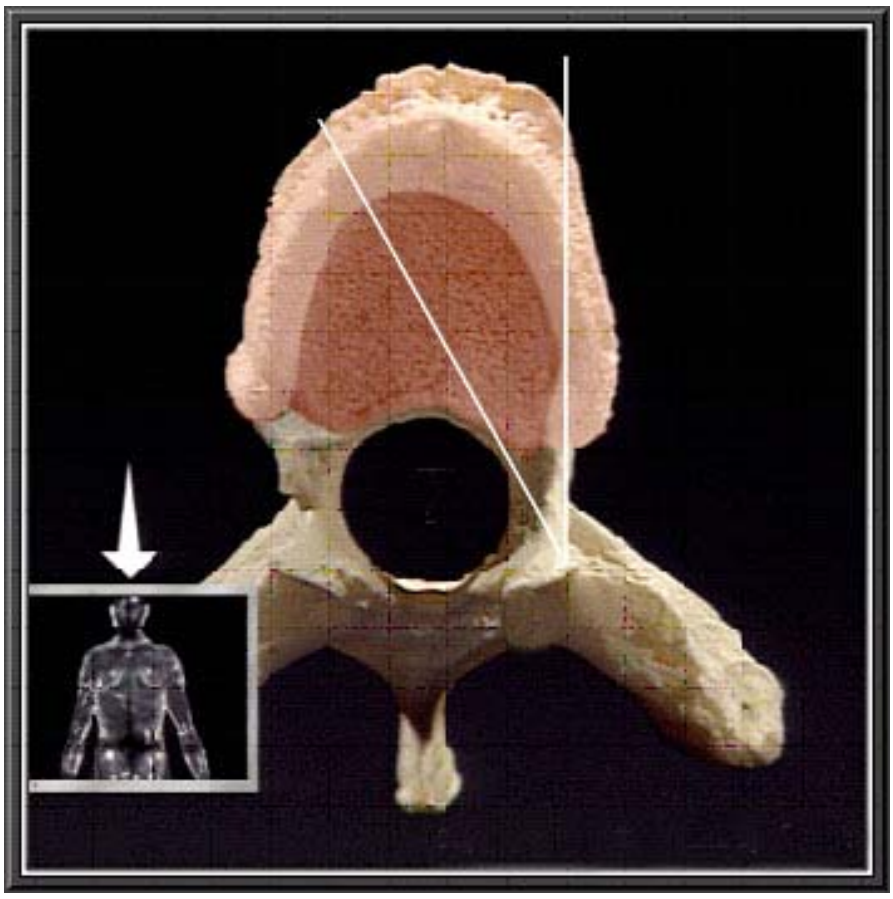
The integrity of the medial and inferior borders of the pedicle must to be preserved at all times. This principle is important to prevent the spread of hematoma, infection or tumor inside the spinal canal and to prevent damage to the dura and nerve root.

COMPARISON OF OUR STUDY WITH INTERNATIONALLY PUBLISHED ARTICLES

Factors	MMC Study	Alexander G Hadjipavlou[1]	Laurent Pierot[2]
No. of cases	20	68	18
No. of biopsy	20	71	18
Age range	22-68 yrs	17-81 yrs	20-87 yrs
Vertebral Level			
Cervical	-	1	-
Dorsal	4	36	11
Lumbar	15	33	7
Sacral	1	1	-
Type of lesion			
Osteolytic	18	15	
Osteoblastic	2	5	
Mixed	-	7	
Biopsy			
Anesthesia	LA - 3 GA - 17	LA - 67 GA - 4	LA - 16 GA - 2
Guidance	C-arm (20 cases)	C-arm (61 cases) CT (7 cases)	C-arm (18 cases)
Complications	Nil	5 cases	Nil
Results			
Conclusive	17	67	16
Inconclusive	3	4	2
Sensitivity	**85%**	**94%**	**89%**

Overall, there were 85% positive results in our studies. This is consistent with the studies made by Alexander G Hadjipavlou[1] and Laurent Pierot[2] with the sensitivity of 94% and 89% respectively.

More than 50% of vertebral body is accessible through unilateral pedicular channel



SUMMARY

Percutaneous transpedicular biopsy is well suited for deep seated lesions like the spine where exploration is a major operation with appreciable risks. Many structures which are a barrier to open biopsy are readily by passed or traversed by the needle.

It is recognized that in neoplastic disease and in infections, the vertebral body is frequently invaded and it also to be noted that biopsy of the vertebra including the marrow frequently was the only proof of metastatic carcinoma or infection, where other tomography scan were positive. The fact is not only of academic interest but has important therapeutic implications.

With the advent of more technology, a closed biopsy has become a readily available procedure. A successful closed biopsy obviates the need for open surgical biopsy which is associated with attendant risks, time and expense.

Advantages of Percutaneous Transpedicular Biopsy

- Duration of the procedure and hospitalization is short.
- Potential for infectious complication is limited.
- The location of the needle can be permanently recorded by radiographs taken at the time of biopsy.
- More than 50% of vertebral body is accessible for biopsy through unilateral pedicular channel.
- Minimal damage and contamination to neural tissues.
- Rapid healing - safe regarding radiotherapy.
- Relatively narrow track of the trocar preserves the supportive tissue thus preventing local hemorrhage associated with open biopsy.
- Less Invasive.
- Smaller specimen of bone obtained, decalcified more rapidly
  - faster results.
- Better patient's tolerance.
- With increasing experience procedure can be done under local anesthesia and as an out patient procedure.
- Cost effective.
- In future same trocar can be used for percutaneous transpedicular decompression, vertebroplasty, discitis etc.

1.

Disadvantages of Percutaneous Transpedicular Biopsy

Sometimes the size of the tissue recovered with a trocar is relatively small and may be insufficient for the pathologist to provide a specific diagnosis.

Limitation of the Percutaneous Transpedicular Biopsy

- Lesions which are predominantly located in the disc space.
- Lesions that involve the lower part of the vertebral body.
- Vertebra Plana
- In suspected cases of renal secondaries, this procedure is to be done with caution as it is highly vascular.

CONCLUSION

- Percutaneous transpedicular biopsy of spine under C-arm guidance is a safe, rapid, reliable, sensitive and cost effective method of obtaining a diagnosis in different spine lesions.
- Performed efficaciously as an out patient procedure with high diagnostic success rate and minimal morbidity.
- Use depends on accurate placement of the trocar and qualified interdisciplinary clinical co-operation.
- Study requires further evaluation with a larger sample for comprehension.

BIBLIOGRAPHY

1. **Alexander G.Hadjipavlou**, **George M.Kontakis**, Effectiveness and pitfalls of percutaneous transpedicular biopsy of the spine. Clinical orthopaedics and retated research vol 411:54-60, June 2003.

2. **Ashizawa R**, **Ohtsuka K**, **Kamimura M**; Percutaneous transpedicular biopsy of thoracic and lumbar vertebrae - methods and diagnostic validity.

3. **Bender CE**, **Berquist TH**, **Wold LE**. Imaging - assisted percutaneous biopsy of the thoracic spine. Mayo clin proc 61 : 942-950, 1986.

4. **Donald L.Renfrew**, Percutaneous Transpedicular Biopsy of the spine, Radiology 180:574-576, 1991.

5. **Fraser – Hill MA**, **Renfrew DL**: Percutaneous needle biopsy of musculoskeletal lesions cost effectiveness. AJR Am J Roentgenol 158:813-818, 1992.

6. **Fredrick S Craig**: Vertebral body biopsy. Journal of Bone and joint surgery 38A:93-101, 1956.

7. **Fyfe I**, **Henry APJ**, **Mulholland RC**. Closed vertebral biopsy. JBJS 65-B : 140-143,1983.

8. **Hadjipavlou AG**, **Arya S**: Percutaneous transpedicular biopsy of the spine. J.Interv Radiology II : 103-108, 1996.

9. **Hasan Kamil SUCU**, CT guided percutaneas transforminodiscal biopsy sampling of vertebral body lesions J.Neurosurgery (spine 1) 99; 51-53, 2003.

10. **Jean-Denwis**, **Laredo**, **Khaled Lakhdani**, **L.Bellaiche et al**, Acute vertebral colapse. Computed tomography findings in benign & malignat non traumatic cases. Musculo skeletal imaging. Radiological clinics of N.America : 41-48 1995.

11. **Jelinek JS**, **Krunsdof MJ**, **Gray R.** Percuraneous transpedicular biopsy of vertebral body lesious.. Spine 21:2035-40,1996.

12. **Jose Valls**, **Ottolenghi** and **Schajowicz** : Aspiration biopsy in diagnosis of lesions vertebral bodiws – JAMA 136:376-382, 1948.

13. **Kattapuram SV**, **Khurana JS**, **Rosenthal** : Percutaneous needle biopsy of the spine. Spine 17:561-564, 1992.

14. **Kris J.Von Lom et al**., Infection Versus Tumor in the spine. Criteria for distinction with computed tomography. Radiology 166:851-855, 1988.

15. **Laredo JD**, **Bellaiche L**, **Hamze B et al**: Current status of musculoskeletal interventional radiology. Radiol Clin North Am 32:377-398, 1994.

16. **Laurent Pierot** and **Anne Boulin**, Percutaneous Biopsy of the thoracic and lumbar spine; Transpedicular approach under fluoroscopic guidance, Jan 1998.

17. **Lutis Alonso De Santtos**, **John A.Nurray et al**: the value of percutaneous needle biopsy in the management of primary bone tumors. Cancer 43: 735-744, 1979.

18. **Malcolm W.Fidler**: Open transpedicular biopsy of the vertebral body, JBJS (Br) 72-B; 884-85, 1990.

19. **Martin B.Kornblum CT** guided biopsy of the spine. A review of 103 Patients.Spine 23 (1) :81-85,1998.

20. **Mick CA**, **Zinreich J.** Percutaneous trephine bone biopsy of the thoracic spine. Spine 10 : 737-740,1985.

21. **Ottolenghi CR.** Aspiration biopsy of the spine JBJS (AM) 51:1531-1544.1969.

22. **Robertson RC**, **Ball RP.** Destructive spine lesions diagnosis by needle biopsy JBJS (AM) 57:749-785,1935.

23. **Stoker DL**, **Kissin CM**. Percutaneous vertebral biopsy a review of 135 cases. Clin Radiol 36:569-577, 1985.

24. **Stringham DR**, **Hadjipavlou A**, **Lander P**: Percutaneous transpedicular biopsy of the spine. Spine 19 : 1994.

25. **Victor Babu N**, **Titus VTK, Chittaranjan S**. CT guided biopsy of the spine. Spine 19 : 2436-2446,1994.

26. **William A Murphy**, **Judy M.Destouet** and **Louis A.Gilula** Percutaneous skeletal biopsy. A procedure for radiologist result, review and recommandations. Radiology 139: 545-549, 1981.

27. **Wolfgang Ackermann**: Vertebral trephine biopsy. Annals of Surgery 143:373-385, 1956.

28. **Wolfgang Ackermann**: Application of the trephine for bone biopsy JAMA 184:11-17, 1963.

MASTER CHART

S.No.	Age / Sex	Complaints	Motor Weakness	Sensory deficit	Gibbus / Kyphosis	Non-radiological Investigation			Radiological Investigation						Biopsy				HPE Diagnosis	Treatment
						ESR	mantoux	Alk. Pho	Region	Nature of the lesion	CXR	USG	CT	MRI	Site	Anesthesia	Nature of Specimen	Complications		
1	28/M	Back pain	-	-	-	12	-	216	L4	Lytic	+	+	+	-	L4	GA	Fragile Bits	-	Aneurysmal Bone Cyst	Observation
2	25/M	Back pain, leg pain, weakness	+	+	-	18	-	311	L5	Lytic	+	+	+	-	L5	GA	Solid Bits	-	Giant Cell Tumour	Curettage, cementation
3	49/M	Pain, wt. loss, fever, weakness, paresthesia	+	+	+	32	+	272	L4	Lytic	+	-	+	+	L4	GA	Multiple Fragile Bits	-	Tuberculosis	ATT
4	45/M	Pain, wt. loss	-	-	-	18	+	272	L4	Lytic	+	-	+	-	L4	GA	Fragile Bits	-	Inconclusive	---
5	28/F	Pain, wt. loss, fever, deformity	-	-	+	32	+	118	L1	Lytic	+	-	+	-	L1	GA	Solid Bits	-	Tuberculosis	ATT
6	45/F	Pain, fever, wt. loss	+	+	+	18	+	106	L4	Lytic	+	-	+	-	L4	GA	Solid Bits	-	Tuberculosis	ATT
7	55/F	Pain, wt. loss, weakness, paresthesia	+	+	-	52	-	374	L5	Lytic.	+	-	-	-	L5	GA	Solid Bits	-	Metastatic Adenocarcinoma	Radio / chemotherapy
8	22/F	Pain, fever, wt. loss	-	-	+	8	-	116	L1	Lytic	+	-	+	-	L1	GA	Solid Bits	-	Tuberculosis	ATT
9	40/M	Back pain, deformity	-	-	-	23	-	372	L4	Sclerotic	+	+	-	-	L4	GA	Solid bits	-	Paget's disease	Medical Management
10	50/F	Back pain, leg pain, wt. loss, weakness	+	-	-	72	-	312	L5	Lytic	+	+	+	+	L5	GA	Solid Bits	-	Metastatic Adenocarcinoma	Radio / chemotherapy
11	68/M	Pain, fever, jaundice, stiffness, deformity, paresthesia	+	+	+	52	+	211	D9, D10	Lytic	+	+	+	+	D9	GA	Solid Bits	-	Tuberculosis	ATT
12	55/F	Pain, wt. loss, weakness, paresthesia	+	+	-	118	-	412	D12	Sclerotic	+	+	+	+	D12	GA	Solid Bits	-	Metastatic Adenocarcinoma	Radio / chemotherapy
13	26/M	Back pain, leg pain, wt. loss, fever	+	+	+	32	+	119	L5, S1	Lytic	+	-	+	+	L5	LA	Solid Bits	-	Inconclusive	ATT
14	40/F	Back pain, wt. loss	-	-	-	32	-	102	L5	Lytic	+	+	+	+	L5	GA	Solid Bits	-	Metastatic Adenocarcinoma	Radio / chemotherapy

15	50/F	Back pain, leg pain, wt. loss, weakness, paresthesia	+	+	-	42	-	112	D8, D12, L1	Lytic	+	+	+	+	D8	GA	Solid Bits	-	Multiple Myeloma	Chemotherapy
16	23/M	Back pain, wt. loss, fever	-	-	-	18	-	112	S1	Lytic	+	-	+	+	S1	LA	Solid Bits	-	Tuberculosis	ATT
17	31/M	Back pain, leg pain, fever, deformity	+	+	+	32	+	82	D11, D12	Lytic	+	-	-	+	D11	GA	Solid Bits	-	Tuberculosis	ATT
18	22/M	Pain, wt. loss, fever	+	+	-	103	-	156	L3	Lytic	+	+	+	+	L3	LA	Fragile Bits	-	Inconclusive	---
19	31/M	Pain, wt. loss, weakness, paresthesia	-	-	-	32	-	132	L1, L2	Lytic	+	+	+	+	L2	GA	Solid Bits	-	Multiple Myeloma	Chemotherapy
20	35/M	Back pain, leg pain, fever	+	-	+	18	+	111	L4, L5	Lytic	+	-	+	-	L5	GA	Solid Bits	-	Tuberculosis	ATT